Day 166	A Level Maths: A Tier 10-a-day
1 A curve has equation $2x^2 - 2xy - 3y^2 + 3x + 3y = -4$. Show that P$(-2, 3)$ lies on the curve and find the equation of the tangent at P in the form $ax + by + c = 0$ with integer a, b, c.	
2 Solve $4^{x-3} = 8^{x+1}$.	
3 A and B have position vectors $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$ and $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$. The point P lies on AB with AP : PB = 2 : 1. Find the position vector of P and the exact distance OP.	
4 A group of 9 men and 3 women. A team of 4 is chosen at random. Find the probability that the team contains at least one of the women.	
5 A hemispherical bowl of radius 5 cm is filled at 40 cm^3s^{-1}. When the depth is h, $V = \pi(5h^2 - \frac{1}{3}h^3)$. Find $\frac{dh}{dt}$ when h = 4 cm.	

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6 A particle P has position vector $\mathbf{r} = (2t^3 - t)\mathbf{i} + (3t^2 - 6t)\mathbf{j}$ metres at time t s. Find (a) the speed of P when t = 3, (b) the value of t when P is moving parallel to $\mathbf{i}$. Give answers to 3 s.f. if not exact.	
7 X has E(X) = 2 and Var(X) = $\frac{5}{2}$. (a) Find $E(X^2)$. (b) Y = 3X + 7. Find E(Y) and Var(Y). (c) X_1 and X_2 are independent copies of X. Find $Var(X_1 - X_2)$.	
8 Solve $\|x + 3\| > \|-3x - 3\|$.	
9 Find the set of values of k for which the line $y = -3x + k$ meets the curve $y = 2x^2 - 6x - 3$ at two distinct points.	
10 A ball is projected from the ground at 40 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{12}{5}$. At time T s, while in flight, it is moving perpendicular to its initial direction. Find (a) T, (b) the height of the ball then. Take g = 9.8. Give answers to 3 s.f. if not exact.	